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Then, referring to Figure 9, the controller 114 controls the positioning system 103 to scan the activated tip 138 over the reference SPM probe 133. The other components 123 of the SPM system 100 further include a particle measurement control circuit 187, as shown in Figure 87. The controller controls the particle measurement control circuit to cause the SPM probe to produce an e-beam and detect any secondary electrons in the manner discussed later for the e-beam tool 382 of the SPM probe 122-8. The particle measurement control circuit makes a particle measurement of the detected electrons and provides it to the controller. The controller collects the particle measurements and produces an image of the activated tip in the same manner as a conventional particle microscope, such as an electron microscope. From the produced image, the positional offset of the tip at the known position of the SPM probe can be determined. Based on this positional offset, the precise positioning of the tip with respect to the reference location is then calibrated. Moreover, from the produced image, it can be determined whether or not the tip is defective.

Please replace the paragraph beginning at page 26, line 10 with the following rewritten paragraph:

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Referring to Figure 11 again, the second calibration structure 128-2 also includes one or more other reference structures 191 that may be used to calibrate the position of the activated tip 138. These reference structures are formed on an insulating material 199 on the base 190 of the calibration structure. The reference structures may each comprise a conductive tip at <u>a</u> precisely known position with respect to the reference location. Each conductive tip is coated with a conductive material with known conductive properties and is connected to an STM measurement circuit 213. The STM measurement circuit is one of the other components 123 of the SPM system 100.

Please replace the paragraph beginning at page 45, line 17 with the following rewritten paragraph:

C3

Specifically, the SPM probe 122-1 is formed so that the target surface 150 of each tip 138 of the probe on which the obdurate plate 240 is formed is oriented with respect to a particular crystal axis (or direction) 152 of the core material 144 with a desired orientations

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angle. Then, the obdurate plate comprises a crystal that is grown on the target surface of each tip with the crystal growth (or deposition) vector 154 being oriented with respect to the crystal axis of the core material with a desired crystal growth angle. Moreover, during crystal growth of the obdurate plate, a desired bias voltage can be applied to the core material to create an electrical field. By positioning the target surface in the bias electric field and/or a bias magnetic field in different ways about the axis of the crystal growth vector, different orientations (or alignments) of the grown crystal on the target surface can be formed, as shown in Figures 22 and 33. Thus, the orientations and crystal growth angles, the bias voltage, and the position of the target surface about the axis of the crystal growth vector, can be selected to produce a tip with an obdurate plate that has a desired crystal orientation on the target surface. And, it may be made conductive in the same way as was described earlier for the obdurate coating 146 so that it can be used with the STM measurement circuit 213 to make STM measurements.

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Please replace the paragraph beginning at page 46, line 15 with the following rewritten paragraph:

Similarly, the obdurate plate 250 may be formed with a silicon carbide or carbon nitride crystal that has a desired crystal orientation on the target surface 150. In order to do so, the process described earlier for growth of silicon carbide and carbon nitride crystals in forming the obdurate coating 146 would be modified. This would be done in the same way that the earlier described process of growing diamond crystals to form the obdurate coating was modified to grow the diamond crystal that forms the obdurate plate 250.

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Please replace the paragraph beginning at page 46, line 22 with the following rewritten paragraph:

The obdurate plate 250 was just described as being a single crystal grown on the target surface 150 of the core material 144. However, those skilled in the art will recognize that the obdurate plate could be formed by one or more crystals that are grown on the target surface. In this case, the application of the bias voltage to the core material would cause these crystals to be symmetrically aligned.

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Please replace the paragraph beginning at page 47, line 36 with the following rewritten paragraph:

The tip 242 of each SPM tool 239 of the SPM probe 122-3 includes a tapered core material 144 and a multiwalled nanotube (i.e., nanostructured tube) 244. The nanotube may comprise carbon or boron nitride and be formed in the manner described in S. Lijima, "Helical Microtubules of Graphitic Carbon," Nature (London) 354, 56 (1991) and A. Loiseau et al., "Boron Nitride Nanotubes with Reduced Number of Layers Synthesized by Arc Discharge," Physical Review Letters, vol. 76, no. 25 (June 1996), pp. 4737-4740, and Nasreen G. Chopra et al., "Boron Nitride Nanotubes," which are hereby explicitly incorporated by reference. Moreover, in the manner described in Honggjie Dai et al., "Nanotubes as Nanoprobes in Scanning Probe Microscopy," Nature, vol. 334 (November 1996), pp. 147-150, which is also hereby explicitly incorporated by reference. The nanotube is attached to the core material for use in making SPM measurements by bonding it to the core material. And, as described in this reference, the narrow diameter (e.g., 5-20 nanometers) of the nanotube enables it to provide sub nanometer resolution. And, its flexibility allows it to bend back into is original shape and position is case of inadvertent crashes in the object 102 or one of the calibration structures 128.

C6

Please replace the paragraph beginning at page 47, line 33 and ending at page 48, line 10 with the following rewritten paragraph:

Turning to Figures 25, the tip 242 of each SPM tool 239 includes one or more crystals of an obdurate coating 246 on the nanotube 244. Since the ends of the nanotube 244 are closed when formed, as described in "Boron Nitride Nanotubes with Reduced Number of Layers Synthesized by Arc Discharge" just referenced, crystal of the obdurate material can be formed on the closed surface 248 at the free (or unattached) end of the nanotube. Moreover, crystals of the obdurate material may also be grown at the free end on the side walls 250 of the nanotube. As with the probes 122-1 and 122-2, the obdurate coating may comprise diamond, silicon carbide, carbon nitride, diamond like carbon, or some other suitable obdurate material and may be formed the ways described earlier. Thus, as shown in Figure 25, the obdurate coating could comprise a plate on the closed surface 248 and plates on the side walls 250 that are formed with a desired

C7

C7 cont'd

crystal orientation in the manner described earlier for the obdurate plate of each tip 238 of the second probe. And, these plates may be made conductive in the same was as was described earlier for the obdurate coating 146 so that it can be used with the STM measurement circuit 123-11 to make STM measurements.

Please replace the paragraph beginning at page 56, line 12 the following rewritten paragraph:

C8

The particle removal structure 342 includes an inlet (i.e., input port ) 332 on the upper surface 140 on the fifth SPM probe 122-5, a duct 340 formed in the base 130 of the probe, and an outer annular outlet (i.e., output port) 336 on the lower surface 142 of the probe, as shown in Figures 27 and 35. The duct connects the inlet and the outer annular outlet so that they are in fluid communication with each other. As shown in Figure 86, the surface 142 of the base of the SPM probe 122-5 has steps 830 in it.

Please replace the paragraph beginning at page 56, line 24 the following rewritten paragraph:

C9

Similarly, as shown in Figures 27 and 35, the particle removal structure 342 includes an inlet 330 on the upper surface 140 of the fifth SPM probe 122-5, a duct 341 formed in the base 130 of the probe, and an inner annular outlet 335 on the lower surface 142 of the probe. The duct connects the inlet and the annular inner outlet so that they are in fluid communication with each other.

Please replace the paragraph beginning at page 56, line 35 the following rewritten paragraph:

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The inner annular outlet 335 is at a step 831 lower than the step 830 at which the aperture opens out at. The low viscosity gas serves as seal to prevent the high viscosity gas discussed from entering the microvacuum chamber created in the gap between the step 831 and the surface 166 of the object 102. This microvacuum chamber is created in the manner discussed earlier for SPM probe 122-1. Moreover, a differential pressure chamber is created in the gap between the step 830 and the surface of the object. This is created in the same was as the

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microvacuum chamber just mentioned except that the high viscosity gas is introduced rather than a vacuum.

Please replace the paragraph beginning at page 57, line 6 the following rewritten paragraph:

C11

Additionally, the particle removal structure 342 includes an outlet 331 on the upper surface 140 of the fifth SPM probe 122-5, a duct 339 formed in the base 130 of the probe, and a middle annular inlet 337 on the lower surface 142 of the probe, as shown in Figures 27 and 35. The duct connects the outlet and the annular middle inlet so that they are in fluid communication with each other.

Please replace the paragraph beginning at page 85, line 21 the following rewritten paragraph:

C12

For example, it may be desire to deposit diamond like carbon on the object 102 to make the object harder. In this case, the fluid could be argon, the material of the cathode 487 would be carbon, and the other components 123 of the SPM system 100 would include a magnetic field source to create a magnetic field for deposition of the diamond like carbon. This may be done in the manner and under the conditions discussed in "Multilayer Hard Carbon Films with Low Wear Rates," by Joel W. Ager et. al., Surface and Coatings Technology, vol. 91, pp. 91-94, May 1997, "Properties of Vacuum Arc Deposited Amorphous Hard Carbon Films," by Simone Anders et al., Applications of Diamond Films and Related Materials: The Third International Conference, pp. 809-812, 1995, "Hardness, Elastic Modulus, and Structure of Very Hard Carbon Films Produces by Cathodic-Arc Deposition with Substrate Pulse Biasing," by George M. Pharr et al., Applied Phys. Lett., vol. 68 (6), pp 779-781, Feb. 5, 1996, and "Development of Hard Carbon Coatings for Thin-Film Tape Heads," by Bharat Bhushan and B.K. Gupta, IEEE Trans. Magn., vol. 31, 2976-2978, 1995, which are all hereby incorporated by reference. Specifically, this may be done with multiple layers of the diamond like carbon to increase the overall strength of the deposited material.

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